

# PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

### Improvements in or relating to Valve Operating Mechanism for Internal Combustion Engines

5 We, B.M.G. MOTORCYCLES LIMITED, a Company organised under the laws of Great Britain of, 352 High Road, Ilford, Essex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to operating mechanism for the valves of internal combustion engines and particularly to mechanism for effecting fully desmodromic valve operation.

15 According to this invention mechanism for desmodromically operating the valves of an internal combustion engine comprises for each valve a rocker, means positively to move the rocker in two opposite directions, the rocker when moved in one direction, operating the valve to open it, and means for closing the valve pivoted to move about an axis concentric with that of the rocker and operatively connected thereto so that when the rocker is moved in the opposite direction the valve will be returned to its closed position, the operative connection being provided by spring means.

20 Preferably the operating connection is provided by a torsion member connected at one end to the closing means and at its other end to the rocker.

25 In one embodiment of the invention the rocker comprises a hollow spindle mounted for rocking movement about its axis and within which the torsion member is mounted, the torsion member preferably being adjustably connected to the rocker although it could if desired be connected directly thereto. The means for closing the valve comprise an arm having a forked end for engagement with the valve stem or a collar thereon.

30 The hollow spindle carries an arm at one end to operate the valve and at its other end a second arm through which rocking motion is imparted to the rocker to operate the valve.

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35 Preferably rocking motion is imparted to the rocker by a reciprocating rod which is arranged to be reciprocated by a double cam follower pivotally secured to the rod and itself arranged for pivotal movement so as to co-operate with two cams. 50

The invention is described below with reference to the accompanying drawing in which:—

55 Figure 1 is an elevation of a rocker and operating means therefor, the fulcrum for the rocker being omitted;

Figure 2 is a section along the line A—A of Figure 1;

60 Figure 3 is a fragmentary view showing the attachment of the rocker to a reciprocating rod by which it is operated, and

Figure 4 is an elevation of the reciprocating rod showing a modified manner of attaching it to the rocker and rendering it adjustable.

65 Referring to Figures 1 to 3 of the drawing, mechanism for desmodromically operating, i.e. positively opening and closing the valves of an internal combustion engine comprises for each valve a rocker having two arms 1 and 2, the arm 1 being formed for engagement with the head 3 of the valve stem 4 of a mushroom valve 5, which is of conventional type, in order to open the valve. 70

As can be seen from Figure 2, the two arms 1 and 2 are formed at opposite ends of a hollow spindle 6 which is mounted for rocking movement in bearings not shown. 75

Pivotal movement of the rocker is by means of a reciprocating rod 7 to one end of which is pivotally connected at 8 a yoke piece in the form of an inverted "L" shaped arm 9, the limb 10 of which has adjustably secured thereto, by means of lock nuts 11, a threaded stud 12 which is secured to the outer end of the second arm 2 of the rocker. For this purpose the arm 2 is formed with a boss 13 in which is a screw threaded bore for the stud 12. 80 85

Concentrically mounted within the bore 14 of the hollow spindle 6 is a torsion member in the form of a bar 15 by which means for closing the valve comprising a return arm 16 is carried, the arm 16 having a forked end 17 (see Figure 2) which engages with a collar 18 on the valve stem and by means of which the return or closing movement of the valve against its seating (not shown) is obtained. The torsion bar 15 is formed with axially displaced shoulders 19 and 20 to locate collars 21 mounted on the outer ends of the bar 15 and by means of which the latter is freely mounted in the bore 14 so as to permit of relative angular displacement therebetween.

The torsion bar 15 is adjustably secured at one end of the spindle 6 by means 22 which permit the angular separation between the arm 1 and the return arm 16 to be adjusted.

The means 22 comprise a first block 23 which is attached to the end of the spindle 6 for example by welding and has a central hole 24 through which the end of the torsion bar projects, and a second block 25 to which the projecting end of the torsion bar 15 is keyed where it is held by a nut 26. Adjustment is obtained by providing co-operating holes arranged circumferentially in the respective blocks 23 and 25 for example twenty holes in the block 23 and eighteen in the block 25 so as to give a vernier type adjustment. The two blocks, when adjusted, are fixed together by a precision ground steel pin not shown, which is passed through the two holes which are in registry with each other as indicated at 27.

It will be appreciated that by making the angular separation between the forked return arm 16 and the arm 1 adjustable, it is possible to arrange satisfactory operation of the valve without any accurate machining being necessary. It also provides means whereby the valve may be kept closed under tension without putting any undue strains on any part of the operating mechanism since any strain there may be is accommodated by the torsion bar. Furthermore of course by making the torsion bar adjustable any play which may develop with wear or as a consequence of re-grinding of the valves can readily be taken-up.

As shown in Figure 1 the rod 7 is arranged to be reciprocated by a double cam follower 28 which is pivotally attached to the lower end of the rod 7 by a pivot pin 29 and is itself arranged to pivot about a pivot pin 30 fast for example with the engine casing, not shown. The double cam follower comprises two cam follower members 31 and 32 which are arranged to co-operate with cams 33 and 34 respectively, mounted on a shaft 35.

In the embodiment shown the cam follower members 31 and 32 are formed separately and secured together by rivets or welding, but this construction is not essential and the two cam follower members may be formed as an integral whole. The operation of the cams 33

and 34 and double cam follower 28 to bring about reciprocation of the rod 7 will readily be understood from the drawing. Thus in the position shown in Figure 1 the rod 7 which in the present embodiment is arranged vertically, is raised to its highest point by the cam 33 in co-operation with the cam follower member 31 so that the rocker is rocked to cause depression of its arm 1 and hence of the valve stem 4 to open the valve 5. As the cam 33 is rotated in an anti-clockwise direction simultaneous rotation of the cam 34 causes the cam follower 28 to pivot about the pin 30 in a clockwise direction causing downward movement of the rod 7 so as to cause rocking movement of the rocker to bring about raising of the valve stem 4 through the forked arm 16 in contact with the underside collar 18 thereon to close the valve.

Referring to Figure 4 a modified way of attaching the reciprocating rod 7 to the arm 2 of the rocker is shown. As before the arm 2 is provided with a boss 13 in which is a screw threaded bore for the stud 12, but this is not adjustably secured to the limb 10 of the yoke 9 being permanently secured thereto by a single nut 36 and also if desired by welding. The yoke piece is provided with a second limb 37 having a slotted aperture 38 and formed on its upper surface with a part spherical seating 39 for a semi-spherical socket member 40, the aperture being re-bated at its lower end to accommodate movement of a shaft 41 which extends therethrough and is fast with the socket member 40 at its upper end.

As shown the lower end of the stud 12 is formed with an extension 42 in the form of a stud having a part spherical lower end 43 for engagement in a part spherical socket or cup 44 formed in the socket member 40. The shaft 41 is formed with a nut 45 and its lower portion is provided with an external screw thread 46 to engage in an internally screw threaded coupling member 47 into the lower end of which the upper end of the reciprocating body 7, which has an external screw threaded portion is screwed and fixed for example by a pin 48 and also by brazing if desired. The lower end of the reciprocating rod 7 is also externally screw threaded for engagement in an internally screw threaded coupling member 49 in which it is secured in a similar manner to the upper end of the rod to the coupling member 47, the coupling member 49 being fast with the pivot 29 by which the reciprocating rod is attached to the double cam follower 28.

It will be appreciated that the extension 42 in conjunction with the socket member 40 form a double ball and socket type joint which ensures that the upward thrusts of the reciprocating rod are transferred directly to the rocker than through the yoke piece 9 as in the arrangement described in connection with

Figure 3, and which it has been found at very high speeds tends to flex.

During assembly it will be appreciated that the shaft 41 is passed into the slotted aperture 38 to seat the socket member 40 where-  
 5 after the stud 12 is screwed through the socket in the boss 13 until the extension 42 engages in the cup 44 of the socket member which is thus held in position on its seating  
 10 by the extension. The rocker is adjusted by screwing the shaft 41 into the coupling member 47 to the appropriate extent where it is then locked by a locking nut 50.

WHAT WE CLAIM IS:—

15 1. Mechanism for desmodromically operating the valves of an internal combustion engine comprising for each valve a rocker, means positively to move the rocker in two opposite directions, the rocker when moved in one  
 20 direction, operating the valve to open it, and means for closing the valve pivoted to move about an axis concentric with that of the rocker and operatively connected thereto so that when the rocker is moved in the oppo-  
 25 site direction the valve will be returned to its closed position, the operative connection being provided by spring means.

2. Mechanism as claimed in claim 1 in which the operative connection is provided by  
 30 a torsion member connected at one end to the closing means and at its other end to the rocker.

3. Mechanism as claimed in claim 2 in which the rocker comprises a hollow spindle  
 35 mounted for rocking movement about its axis and within which the torsion member is mounted.

4. Mechanism as claimed in claim 3 in which the means for closing the valve com-  
 40 prises an arm having a forked end for engagement with the valve stem or a collar thereon.

5. Mechanism as claimed in claim 3 or 4 in which the hollow spindle carries an arm at  
 45 one end to operate the valve and at its other end a second arm through which rocking motion is imparted to the rocker to operate the valve.

6. Mechanism as claimed in any of claims 2 to 5 in which the torsion member is adjust-  
 50 ably secured to the rocker.

7. Mechanism as claimed in any of the pre-  
 ceding claims in which the rocker is operated  
 by a reciprocating rod.

8. Mechanism as claimed in claim 7 in  
 55 which the rocker is adjustably connected to the reciprocating rod.

9. Mechanism as claimed in claim 7 in  
 60 which the length of the reciprocating rod is adjustable so as to effect adjustment of the rocker.

10. Mechanism as claimed in claim 7, 8 or  
 9 in which the rocker is secured to the re-  
 ciprocating rod by means including a double  
 ball and socket type joint.

11. Mechanism as claimed in any of the  
 65 claims 7 to 10 in which the connection between the rocker and the reciprocating rod comprises a yoke piece having two limbs to one of which the rocker is secured, the other  
 70 being provided with a part spherical seating for a part spherical socket member operatively secured to the reciprocating rod and which is held on its seating by a stud extending from  
 the first mentioned limb, the free end of the  
 stud being part spherical to engage in a socket  
 75 or cup formed in the socket member.

12. Mechanism as claimed in any of claims  
 7 to 10 in which the reciprocating rod is  
 80 arranged to be reciprocated by two cams and a double cam follower pivotally secured to the opposite end of the rod and itself arranged for pivotal movement.

13. Mechanism for effecting desmodromic  
 operation of the valves of an internal combus-  
 85 tion engine substantially as herein described with reference to Figures 1 to 3 or 4 of the accompanying drawing.

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COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of  
the Original on a reduced scale

